

Extension Frame, F-EXT4 (Rev. 01)
Extension Module, M-EXT (Rev. 00)

All specifications subject to change without notice

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*Datex AS/3 Extension Frame and Module
Service Manual*

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*Datex AS/3 Extension Frame and Module
Service Manual*

INTRODUCTION

The Extension Frame provides four additional module slots, and enables taking the measuring modules near to the patient. The Extension Frame is connected to the AS/3 Anaesthesia Monitor with the Extension Module, which reserves one module slot.

NOTE:

- * Only one F-EXT4 can be connected to the monitor at a time.
- * The Recorder Module, M-REC, and Memory Module, M-MEM cannot be used in the Extension Frame.
- * Do not use identical modules simultaneously in the Extension Frame and the monitor.
- * When the Extension Frame is used with the AS/3 Anaesthesia Monitor the Central Unit must be of Rev. 03 (F-CU8-XX-03).

I SPECIFICATIONS

Frame size W x D x H (w/module)	160 x 205 x 137 mm 160 x 228 x 137 mm
Frame weight	1.3 kg
Power consumption:	35 W (max at input voltage of +32 V) with ESTP and NIBP modules inserted and NIBP pump working.
Module size (W x D x H)	37 x 180 x 112 mm 1.5 x 7.1 x 4.4 in

2 FUNCTIONAL DESCRIPTION

The Extension Frame, F-EXT4, contains the Module mother board, Power supply board, and space for four single-width or two double-width AS/3 modules. See figure 1.

The electronic unit receives +32 V from the AS/3 monitor frame and generates from it necessary operational voltages for the inserted AS/3 modules.

The received +32 V is passed through fuse (F1) and filtered and led to power supply components.

There is overvoltage and undervoltage protection for input voltage, the input voltage is set so that it can vary between +18.5 V and +36.0 V.

The purpose of the soft start is to raise input voltage +32 V slowly (about 1 second) to the maximum value so that capacitors in power supply components' circuits have time to get charged. This enables E-EXT4 to be connected to AS/3 monitor frame during operation.

There is also overvoltage protection for outgoing supply voltages. The overvoltage limits are +5.95 V (+5 V) and +17.50 V (+15 Vd).

Signal routes

There are two connectors which are used for data communications (RS485), for supply voltages (+32 V, +15 Vd, +15 Va, and +5 V), for grounds connections (GNDD, GND&SHIELD) between the Power supply board and Module mother board.

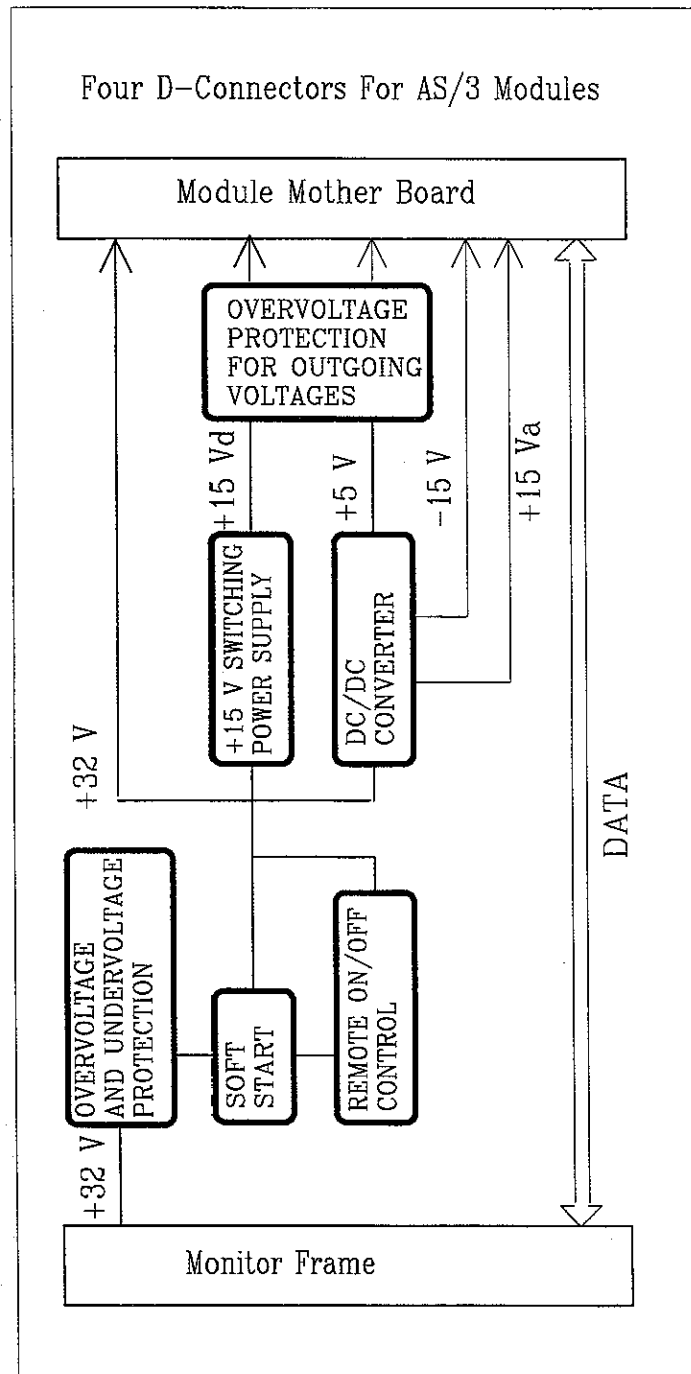


Figure 1 F-EXT Electronics Unit Block Diagram

Extension module rear panel 25-pin female D-connector (X1)

Pin No	I/O	Signal
1	I	RESET_RS485*
2	I	-15 VDC*
3	I	+15 VDIRTY*
4	I	+15 VDC*
5	I/O	-DATA_RS485*
6	I/O	DATA_RS485*
7		Ground & Shield*
8	I	-RESET_RS485*
9	I	CTSB
10	O	RTSB
11	I	RXDB
12	O	TXDB
13		Ground & Shield*
14	I	+32 VDIRTY*
15	I	GroundDIRTY*
16	I	CTSC
17	O	RTSC
18	I	RXDC
19	O	TXDC
20		ON/STANDBY*
21		BIT0IN*
22		RXDD_RS232
23		TXDD_RS232
24	I	+5 VDC*
25	I	+5 VDC*

*** Used in the Extension Frame and Module**

3 SERVICE PROCEDURES

Field service of the Extension Frame, F-EXT4, is limited to replacing the faulty circuit boards or mechanical parts. Return the faulty boards to Datex for repair.

Datex is always available for service advice. Please provide the unit serial number, full type designation, and a detailed fault description.

CAUTION: Only trained personnel with the appropriate tools and equipment shall perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.

3.1 Disassembly and Reassembly

Disassemble the Extension Frame, F-EXT4 in the following way.
See the exploded view in chapter 6.2

- a) Remove the four screws from the front of the frame. PC boards' block is detached.
- b) Remove the four screws from Module mother board with which it is attached to the rear frame.
- c) Lift carefully Module mother board and Power supply board attached to it and detach the two connectors under the Power supply board.

3.2 Changing the Fuse

Disassemble as described above. Fuse is located on the Power supply board.

Replace the fuse by the one with the same type and rating.

4 TROUBLESHOOTING

TROUBLE	CAUSE	TREATMENT
F-EXT4 does not work.	Connector not connected properly. Cable / Extension module is faulty.	Check connectors. Check cable/module.
F-EXT4 does not work.	Incoming voltage too high or too low.	Adjust the voltage to within the range. See the voltage limits in the text.
F-EXT4 does not work.	PC board(s) faulty.	Check the fuse on the Power supply board Check the PC boards and their connections. Change Power supply board.
Fuse on Power supply board is blown repeatedly.	Short-circuit in output voltages.	Change the fuse. Remove AS/3 modules and turn power on. If works, AS/3 module is faulty. If not, check the PC boards. Change Power supply board.

5 SERVICE MENU

There is no service menu for Extension frame checking.

6 SPARE PARTS

6.1 Spare Parts List

NOTE: Only changed part numbers are listed under later revisions. To find the desired part: check first the list of the revision that corresponds your device. If the part is not listed there, check the previous revision, etc. until you find the right number.

NOTE: Accessories are listed in the booklet AS/3 Supplies and Accessories.

Item numbers refer to the exploded view in chapter 6.2.

4-Module Extension Frame, F-EXT4

Rev. 01

<u>Item</u>	<u>Item description</u>	<u>Order No.</u>
4	Module mother board, F-EXT4	884839
3	Power supply board, F-EXT4	*884840
5	Frame with rubber pads	881233
10	Pad	65144
1	Rear frame	881234
2	Fuse T2.5A fast	*51118
6	Internal connector cable	884838
7	Cross cylinder-head screw M3x6	61721
9	Cross cylinder-head screw M3x12	61736
8	Nut bushing M3x9	640455

Extension Module, M-EXT

<u>Item</u>	<u>Item description</u>	<u>Order No.</u>
1	Module box (single width)	879095
3	Latch	879181
2	Spring pin	879182
5	Cross recess screw M3x8 black	616215

* = the part is recommended for stock

6.2 Exploded View of Extension Frame

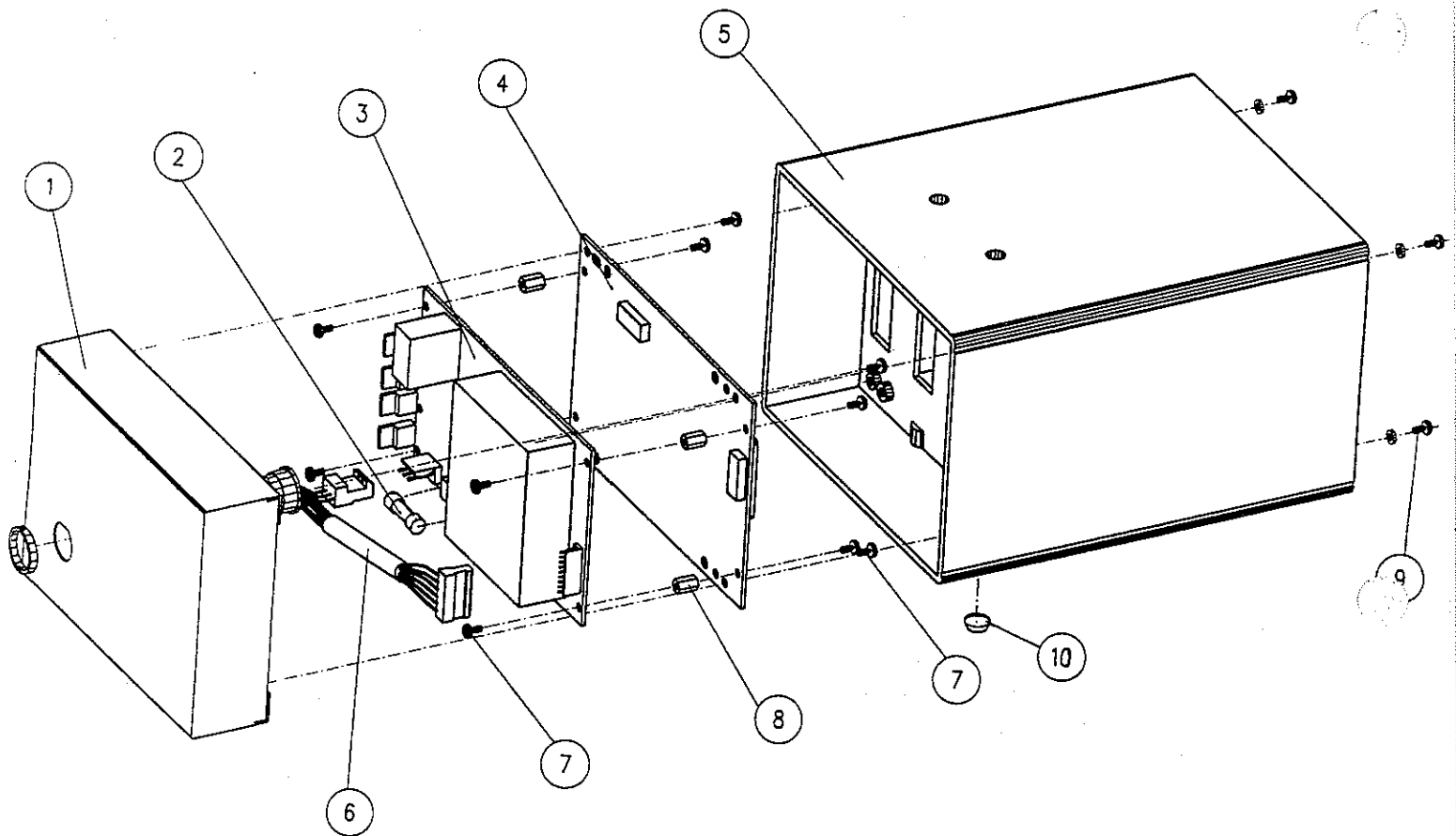


Figure 2 Exploded View of the Extension Frame

7 EARLIER REVISIONS

This manual fully supports earlier revision of F-EXT4.

Memory Module, M-MEM (Rev. 01)
Memory Board, B-CMMEM (Rev. 01)

All specifications subject to change without notice

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INTRODUCTION

AS/3 Memory Module (M-MEM) is an optional data storage module for AS/3 family monitors. It is used for storing patient related physiological data, discrete record keeping events, menu configurations and user defined monitor configurations in removable PCMCIA¹ compatible memory cards.

Memory module can be utilized in the following applications:

1. As a backup media for patient related physiological and record keeping data.
2. As a local menu server for the monitor it is attached to.
3. A Memory card with its previously recorded patient data can be transported to a new monitor location with the patient enabling continuous data collection.
4. To save and load user defined monitor configurations.

The memory module is available in two versions:

1. Single-width external plug-in Memory Module M-MEM for AS/3 Monitors.
2. Internal memory board B-CMMEM for AS/3 Compact Monitor.

The two versions share the same electronics and software. However, because of the special space requirements of the Compact Monitor, the internal version of the module has different printed circuit board layout and mechanical design.

The internal version of the module will use one PC board slot in the AS/3 Compact Monitor.

Memory module has two card slots, which use rewritable PCMCIA-ATA specification compatible memory cards: Data and Menu MemCards.

The Data card is used for storing patient related data and record keeping events, and the Menu card is used as a storage media for pre-recorded menu configurations and user defined monitor

configuration. If the module is used only for data backup and transportation, the Menu card is not necessarily required. Similarly, if only record keeping configurations are needed, Data card does not have to be present. In the latter case, however, no physiological or event data can be stored in a memory card.

Module software runs under MS-DOS² compatible operating system provided by Datalight³. The files created in Data and Menu MemCards are MS-DOS compatible.

The communication between the monitor CPU and the Memory module is performed through high-speed internal TTL level RS-232 serial interface. Data transfer rate is 76.8 kbits/second.

1 Personal Computer Memory Card International Association

2 MS-DOS is a trademark of Microsoft Corporation

3 Datalight is a trademark of Datalight, Inc.

NOTE: Memory Module, M-MEM, cannot be used in the Extension Frame, F-EXT4.

NOTE: The M-MEM rev. 00 uses Microsoft Dos Flash File System (FFS) compatible cards only.

NOTE: S-STD95/S-ARK95 and later main software revisions support only PCMCIA-ATA cards (used in the M-MEM rev. 01) not Flash File cards.

S-STD94/S-ARK94 software supports Flash File cards (used in M-MEM rev. 00) not PCMCIA-ATA cards.

I SPECIFICATIONS

I.1 General Specifications

M-MEM

Module size:	37 x 180 x 112 mm
(W x D x H)	1.5 x 7.1 x 4.4 in
Module weight:	0.4 kg / 1.0 lbs

Total power:	2 W maximum
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B-CMMEM

Module size:	30 x 170 x 108 mm
(W x D x H)	1.2 x 6.7 x 4.3 in
Module weight:	0.3 kg / 0.6 lbs

Total power:	2 W maximum
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I.2 Technical Specifications

MemCard capacity:	5 Mbytes
Data storage capacity:	5 days of continuous physiological data trends
Operating system:	Datalight ROM-DOS
File system:	MS-DOS compatible
MemCards:	PCMCIA-ATA compatible memory cards

2 FUNCTIONAL DESCRIPTION

The Memory Module **M-MEM** contains MEM PC board and a small LED (light emitting diode) PC board attached to the front panel.

The front panel has a dual PCMCIA card connector for two Datex AS/3 MemCards. Above the card slots there are two push buttons for removing the MemCards from the module, and two memory card specific LEDs. The LEDs are on during memory card read and write operations to notify the user not to remove them until the operation is complete.

The internal module contains B-CMMEM PC board and a connector to a PC board that connects the B-CMMEM to the module bus.

B-CMMEM contains the same components as the MEM PC board with the following differences:

1. B-CMMEM does not contain a module bus connector.
2. B-CMMEM contains a 14-pin connector to a separate connector PC board that is connected directly to the AS/3 bus.

NOTE: Memory Module M-MEM (rev. 00) and B-CMMEM (rev. 00) requires support of Main Software S-STD94 or S-ARK94 and cannot be used together with later main software versions.

2.1 Memory Module M-MEM

2.1.1 Memory Module Board

Processor Section

Basically, Memory module is a single board PC with unnecessary I/O functions removed. The processor is Intel 80C186 compatible and the software runs under DOS operating system. Operating frequency is 16 MHz. The board has 512 kbytes RAM, 448 kbytes ROM, 128 bytes EEPROM and associated buffer circuits for memory operations.

Intel 82365SL compatible PC Card Interface Controller (PCIC) provides all the functions needed in MemCard operations. Serial communication, EEPROM read and write operations and LED control is accomplished through a QUART circuit. In addition, processor board contains circuitry to control reset signals and MemCard programming voltages.

Memory module board block diagram is shown in Figure 1.

PCMCIA Card Interface

MEM has PCMCIA compatible card sockets for two MemCards. Both sockets consist of 60 signal and 8 power connections. MemCards are PCMCIA-ATA compatible, and their memory capacity is 5 Mbytes.

NOTE: Memory Module M-MEM (rev. 00) and B-CMMEM (rev. 00) are not supporting use of PCMCIA-ATA MemCards.

All MemCard read and write operations as well as card power management are controlled by PCIC interface controller.

Card removals and insertions are also detected by the interface controller.

MemCard files are MS-DOS compatible and they can be copied for archival with any MS-DOS compatible computer equipped with PCMCIA-ATA specification compatible card drive.

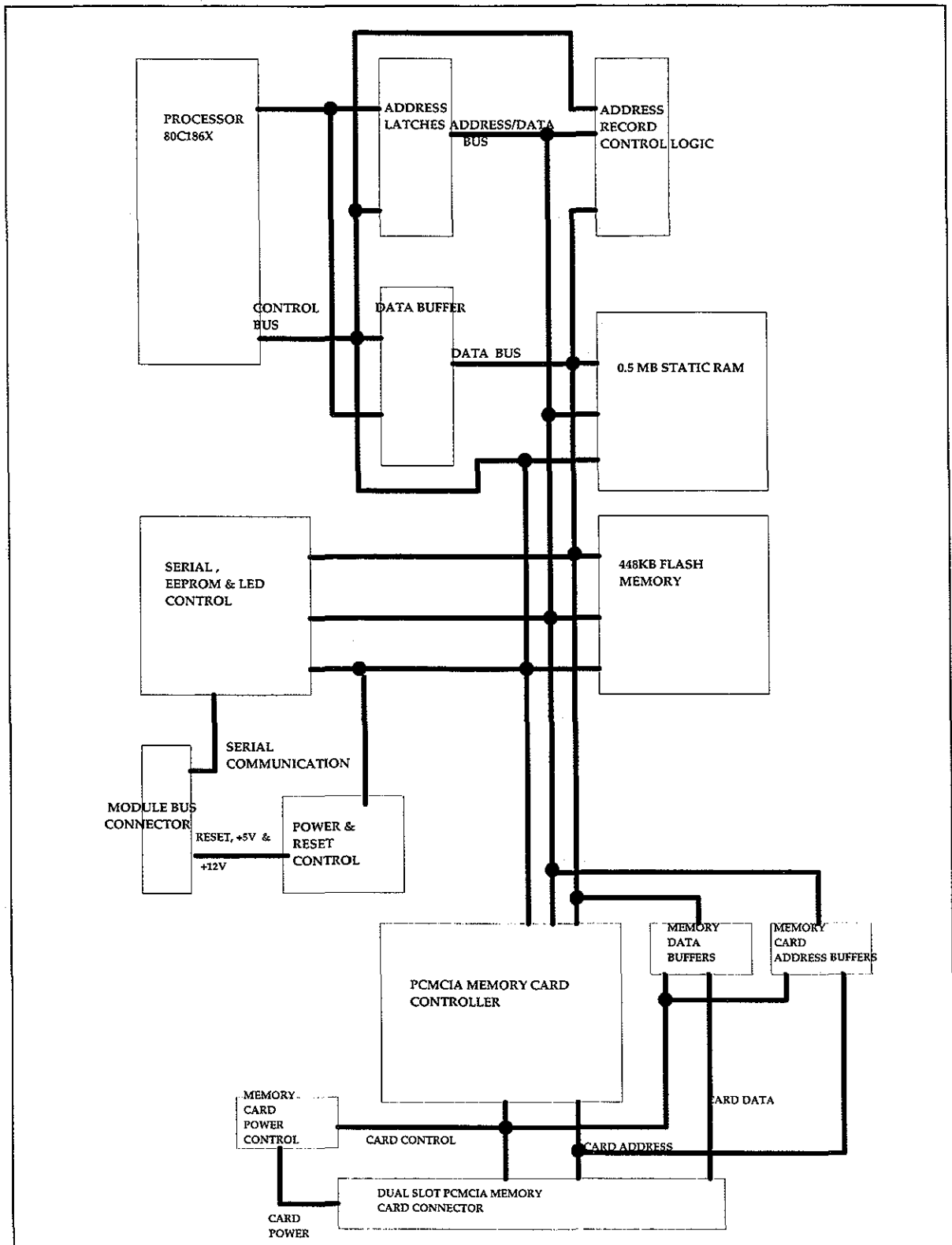


Figure 1 Memory Module Block Diagram

Serial Communication

Serial communication between the module and host monitor is done through module bus TTL-level RS-232 interface. Data transfer rate is 76.8 kbits/second.

RS485 type monitor reset signal is converted to module reset by an interface transceiver, and power reset is generated by a reset circuit.

Power Supply

Module receives its power (+5V, +15V) from the host monitor. PCMCIA card programming voltage + 12V is generated from +15V by voltage regulators. Card programming voltage is controlled by an interface controller. Otherwise, only +5V power is used in the module. Maximum power consumption is 2 Watts.

2.1.2 LED Board

LED board contains only two yellow light emitting diodes and a three-lead cable to the MEM PC board.

2.2 Memory Board, B-CMMEM

2.2.1 B-CMMEM Board

Differences between Memory Module Board and B-CMMEM

Module signals are taken to B-CMMEM through a separate connector board that is connected to the module bus. B-CMMEM is connected to the connector board by a 14-lead connector board cable.

Otherwise Memory module PC board and B-CMMEM PC board have the same components.

2.2.2 Connector Board

B-CMMEM connector board connects B-CMMEM to the AS/3 bus. It contains only CPU bus connector that is connected to the

CPU Mother board, connector to B-CMMEM, and filtering capacitors for +5V and +15V power supply lines.

2.3 Connectors and Signals

Module rear panel 25-pin female D-connector (X1)

Pin No	I/O	Signal
1	I	RESET RS485*
2	I	-15 VDC
3	I	+15 VDIRTY
4	I	+15 VDC*
5	-	-DATA RS485
6	-	DATA RS485
7	-	Ground & Shield*
8	I	-RESET RS485*
9	I	CTSB
10	O	RTSB
11	I	RXDB
12	O	TXDB
13	-	Ground & Shield*
14	I	+32 VDIRTY
15	I	GroundDIRTY
16	O	CTSC*
17	I	RTSC*
18	O	RXDC*
19	I	TXDC*
20	-	ON/STANDBY
21	-	BIT0IN
22	-	RXDD RS232
23	-	TXDD RS232
24	I	+5 VDC*
25	I	+5 VDC*

* Used in MEM module

LED board connector (X5)

Pin No	I/O	Signal
1	O	+5V
2	O	LED1 control
3	O	LED2 control

Connector board 14-pin connector (X1)

Pin No	I/O	Signal
1	I	Ground & Shield*
2	I	Ground & Shield*
3	I	-RESET RS485*
4	I	+15 VDC*
5	I	RESET RS485*
6	O	CTSC*
7	I	RTSC*
8	O	RXDC*
9	I	TXDC*
10	-	N/C
11	-	N/C
12	-	N/C
13	I	+5 VDC*
14	I	+5 VDC*

3 SERVICE PROCEDURES

3.1 General Service Information

Field service for the Memory module is limited to replacing faulty PC boards, MemCards or mechanical parts. The faulty PC boards and MemCards are then returned to Datex for repair.

Datex is always available for service advice. Please provide the unit serial number, full type designation, and a detailed fault description.

CAUTION: Only trained personnel with the appropriate tools and equipment shall perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.

3.2 Preventive Maintenance Checks

We recommend you to perform these checks at least once a year and after any service to keep the Memory Module in good condition.

Items marked (M-MEM) are valid for external Memory Module, M-MEM, only.

1. Visual inspection

- ___: If the module is disassembled, check that all connectors are properly connected and that there are no loose objects inside the module before attaching the module box (M-MEM).

2. Functional checks

- ___: Insert the module in the monitor frame (M-MEM).
- ___: Turn the power on by ON/STBY-switch and wait until the waveform fields appear on the screen.
- ___: Insert MemCard labelled 'Menu' in the left hand side card slot.
- ___: Confirm that the led above the menu card slot turns briefly on (M-MEM).
- ___: Confirm that a text 'Menu card inserted' appears on the message field of the monitor display.
- ___: Confirm that a white menu card symbol appears on the upper right hand corner of the monitor display. (*)
- ___: Insert MemCard labelled 'Data' in the right hand side slot of the module.
- ___: Confirm that the led above the data card slot turns briefly on (M-MEM).
- ___: Confirm that a text 'Data card inserted' appears on the message field of the monitor display.

- ___: Confirm that a green Data card symbol appears on the upper right hand corner of the monitor display.(*
- ___: Pull out the module. The card symbols disappear within 35 seconds, and a text 'Memory Module removed' appears on the message field of the monitor display (M-MEM).
- ___: Reinsert the module while the power is still on. 'Memory Module removed' text disappears and card symbols appear again on the display (M-MEM).
- ___: Go into Service Menu, Service View, Modules, Memory Module, Communication and check the functions.

***NOTE:** Battery symbol will override card symbols in Compact Monitor.

3.3 Disassembly and Reassembly

The Memory module is disassembled in the following way. See section 6.2 for the exploded view of the module.

- a) Remove the two screws from the back of the module.
- b) Pull the module box slowly to detach it from main body. Be careful with loose latch and spring pin for locking.
- c) Remove the two screws that are located on the module bus connector and the screws that connect the front panel frame to the Memory board.
- d) Disconnect the LED board cable and remove the front panel frame.
- e) Remove the EMC cover carefully from around the Memory board.
- f) Reassemble the module in reverse order.

CAUTION: When reassembling the module, make sure the cables, especially the LED board cable, are reconnected properly.

4 TROUBLESHOOTING

4.2 Troubleshooting Charts

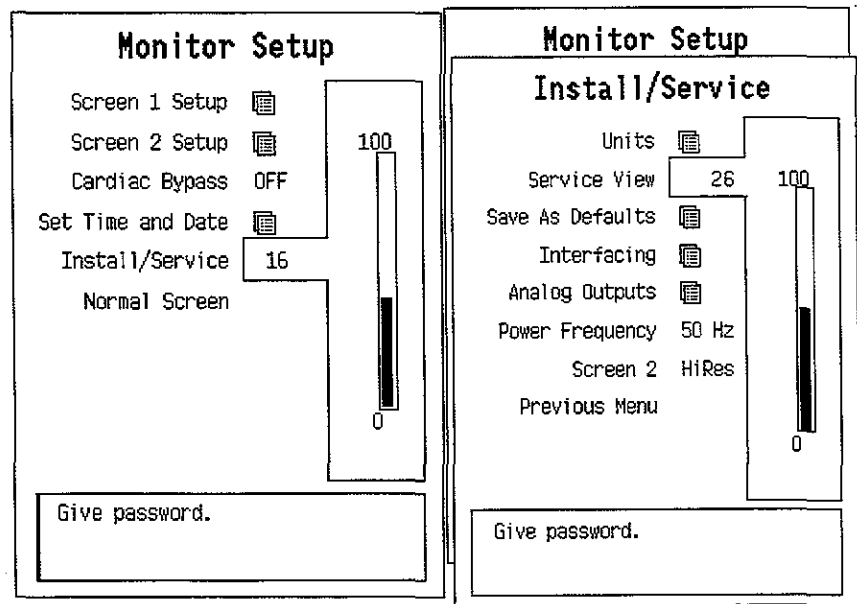
Memory Module

TROUBLE	CAUSE	TREATMENT
Memory module removed -message	Module removed from monitor frame. Possible error in data communication between the module and the monitor.	Insert module in the module frame. Remove module briefly from the monitor. Insert module back to monitor frame.
Memory module error -message	Module has detected an error condition.	If message persists, remove module for repair.
Memory module comm. error -message	Module not properly attached to monitor frame.	Check module attachment.

Memory cards

TROUBLE	CAUSE	TREATMENT
Two Data Cards in mem. module -message	Two Data cards detected.	Remove MemCard from the left hand side slot of the module.
Two Menu Cards in mem. module -message	Two Menu cards detected.	Remove MemCard from the right hand side slot of the module.
No menus in Menu Card -message	There are no menus in the Menu card.	Insert a Menu card with valid menu configuration files in the module.
Faulty Data Card - change card	An error has occurred during Data card read/write operation	Change Data card.
Faulty Menu Card - change card	An error has occurred during Menu card read/write operation	Change Menu card.

5 SERVICE MENU



To enter Service Menu during normal operation:

1. Press the MONITOR SETUP key.
The Setup menu appears.
2. Turn ComWheel to highlight Install/Service and push.
3. Give the password by turning the ComWheel to display each password number and confirm the number by pushing the ComWheel. Password numbers are 16 - 4 - 34.
The Install/Service menu appears.
4. Turn the ComWheel to highlight Service View and push.
5. Give the password by turning the ComWheel to display each password number and confirm the number by pushing the ComWheel. Password numbers are 26 - 23 - 8.
6. Turn the ComWheel to highlight Modules and push.
7. Turn the ComWheel to highlight Memory Module and push.

5.1 Module Status

Memory Module	Module Status	
Module Status	Module present	YES
Communication	Module active	YES
Previous Menu	ROM	OK
	RAM	OK
	PCMCIA	OK
	EEPROM	OK
	Card type	SLOT1 MENU
	File system	ATA
	Card size	5074 kB
	Card used	905 kB
	Card full	NO
	Card empty	NO
	Nbr of files	260
	Oldest file	23 Dec 1994
	Newest file	6 Apr 1995
	Read error	NO
	Write error	NO

Detailed Description

Module present indicates whether the module is firmly attached to the monitor. Possible values are YES and NO.

Module active indicates whether the module services are available. Possible values are YES and NO.

ROM indicates the status of the ROM memory of the module. Possible values are OK and ERR.

RAM indicates the status of the RAM memory of the module. Possible values are OK and ERR.

PCMCIA indicates the status of the PCMCIA controller of the module. Possible values are OK and ERR.

EEPROM indicates the status of the EEPROM memory of the module. Possible values are OK and ERR.

SLOT1 and **SLOT2** indicates the left hand slot and the right hand slot, respectively.

Card type indicates whether the card is MENU or DATA card. If duplicated card is inserted, type DUPL.

File system indicates the type of the used memory card. The only supported file system is ATA. If a memory card using another file system is used, the message UNKNOWN is shown. If the card is poorly attached, the message LOOSE is shown.

Card size indicates the total amount of the disk space in the card in kilobytes.

Card used indicates the total amount of the used disk space in the card in kilobytes.

Card full indicates whether the all disc space in the card is used. Possible values are YES and NO.

Card empty indicates the lack of menu files in the MENU card or no files in the DATA card. Possible values are YES and NO.

Nbr of files tells the amount of the files stored in the card.

Oldest file tells the date of the oldest file in the card.

Newest file tells the date of the newest file in the card.

Read error indicates whether the reading from the card has failed. Possible values are YES and NO.

Write error indicates whether the writing to the card has failed. Possible values are YES and NO.

All values can be '---' to indicate 'No data available'.

NOTE: This menu is related to S-STD95/S-ARK95 Main Software. If S-STD94/S-ARK94 Main Software is used, only Communication menu is available (SERVICE VIEW/MONITOR/COMMUNICATION/MEMORY MODULE).

5.2 Communication

Memory Module	Communication		
Module Status	Interface status ACTIVE		
Communication	Message types	Tx	Rx
Previous Menu	Record K	97	98
	File Op.	0	0
	Service	0	0
	Modes	0	0
	Module status	5	5
	Packets total	102	103
	Bytes total	6203	35142
	Timeouts	0	
	Checksum err	0	
	Length err	0	
	Duplicated	0	

Detailed Description

Interface status indicates the status of data link between the monitor and memory module. If memory module is properly attached, the status should always be on ('ACTIVE'). If status blinks between 'ACTIVE' and 'CLOSED', a communications error has occurred: remove module briefly, and insert it back to the monitor frame to check if error disappears.

Message types indicates the type of data packets that have been sent (Tx) and received (Rx) since last monitor start. Data types are listed on the lines below 'Message types' text.

Record K indicates the communication between the Monitor and Record Keeper.

File Operation indicates the operations of Patient data.

Service indicates the Memory Module operations.

Modes indicates the User Mode operations.

Packets total indicates the total amount of data packets that have been sent/received since last monitor start.

Bytes total indicates the total amount of data bytes that have been sent/received since last monitor start.

The last four lines indicates transmission errors:

- **Timeouts** indicates the number of time-outs that have occurred in memory module data transmission since last monitor start.
- **Chksum err** indicates the number of checksum errors in data packets from memory module since last monitor start.
- **Lenght err** indicates the number of data packets with erroneous length from the memory module since last monitor start.
- **Duplicated** indicates the number of duplicate data packets from the memory module since last monitor start.

6 SPARE PARTS

6.1 Spare Parts List

NOTE: Only changed part numbers are listed under later revisions. To find the desired part: check first the list of the revision that corresponds your device. If the part is not listed there, check the previous revision, etc. until you find the right number.

NOTE: Accessories are listed in the catalogue AS/3 Supplies and Accessories.

Item numbers refer to the exploded view in chapter 6.2.

Memory Module, M-MEM

Rev. 00

<u>Item</u>	<u>Item description</u>	<u>Order No.</u>
12	Memory board, M-MEM	*883509
6	Front panel sticker, M-MEM	884597
4	Front panel frame, M-MEM	883838
7	LED board, M-MEM	885252
1	Module box (single width)	886167
3	Latch	879181
2	Spring pin	879182
8	Metal frame	879184
5	Cross recess screw M3x8 black	616215
9	Cross cylinder-head screw M3x6	61721
10	Cross cylinder-head screw M3x12	628700
11	EMC cover, M-MEM	885860
13	Insulation plate, M-MEM	886656
14	Slotted cylinder-head screw 4-40 UNCx1/4	61371
Memory Card, Menu (Eng)		*885195
Memory Card, Data (Eng)		*885196
Memory Card, Menu (Fre)		*885552
Memory Card, Data (Fre)		*885553

Rev. 01

<u>Item description</u>	<u>Order No.</u>
Memory Card, Menu (Eng)	*887044
Memory Card, Data (Eng)	*887045
Memory Card, Menu (Fre)	*887046
Memory Card, Data (Fre)	*887047

NOTE: The memory cards listed above require revision 01 module, and S-STD95/ARK95 or later software.

Memory Board, B-CMMEM

<u>Item description</u>	<u>Order No.</u>
Connection board, B-CMMEM	885680
Memory Card, Menu (Eng)	*887044
Memory Card, Data (Eng)	*887045
Memory Card, Menu (Fre)	*887046
Memory Card, Data (Fre)	*887047

* = the part is recommended for stock

6.2 Exploded View of Module

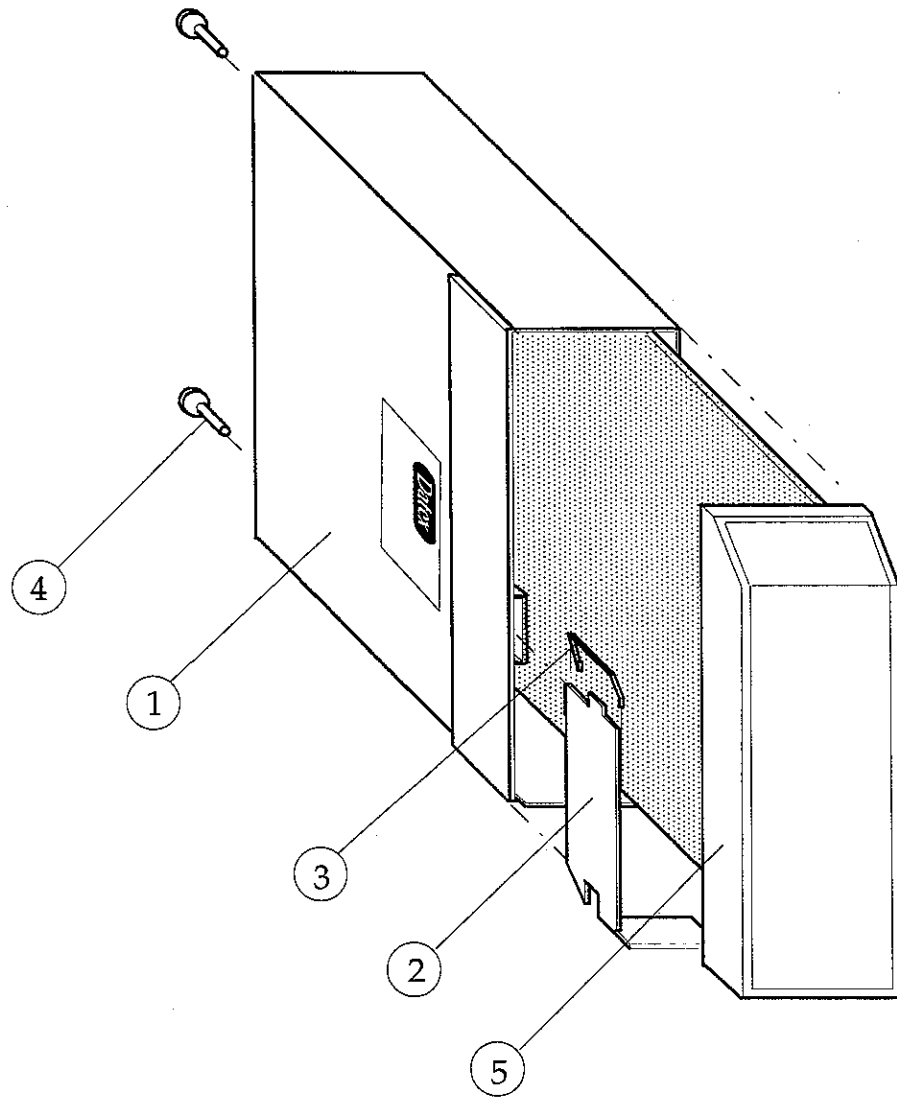


Figure 2 Exploded View of Module Box

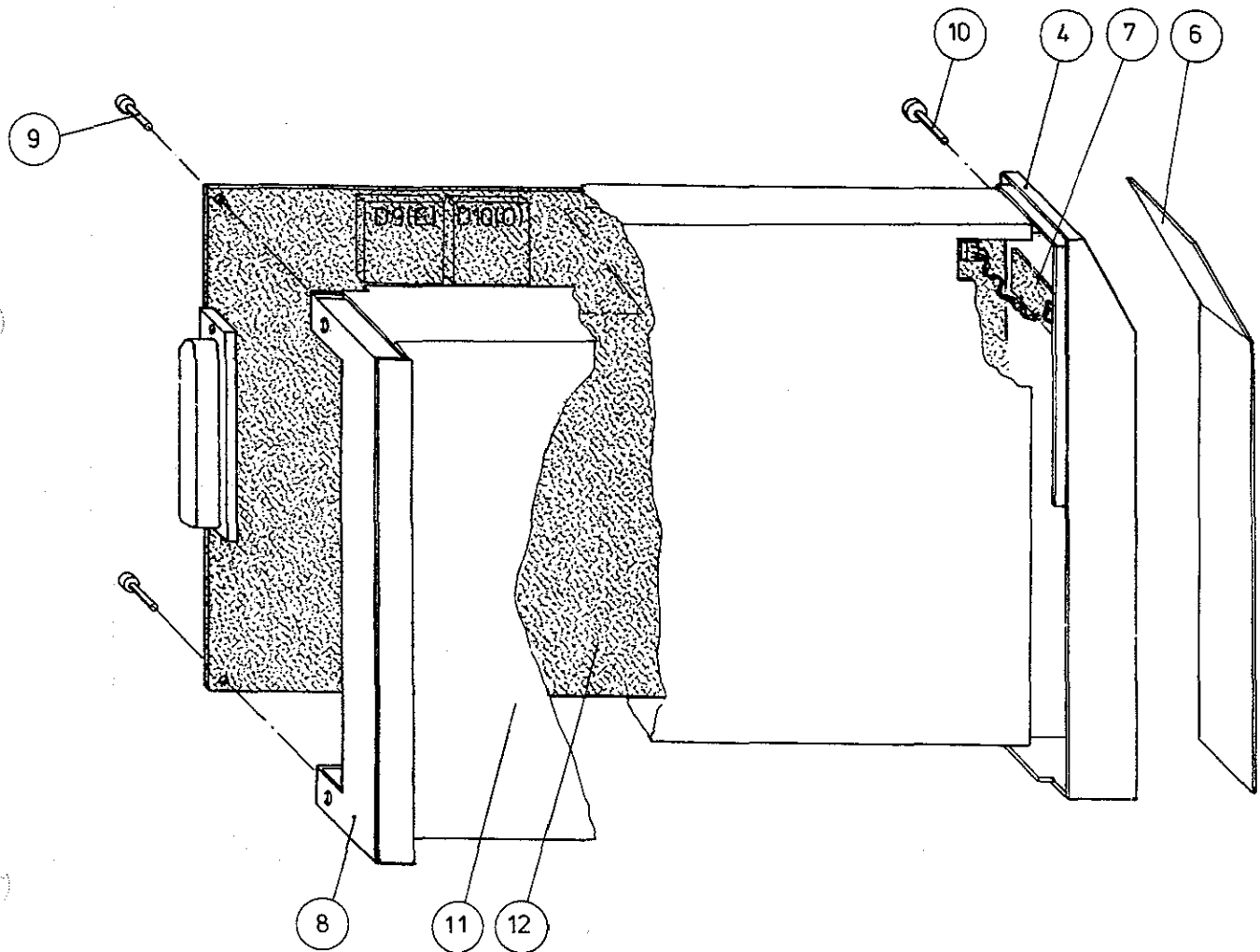


Figure 3 Exploded View of Memory Module, M-MEM

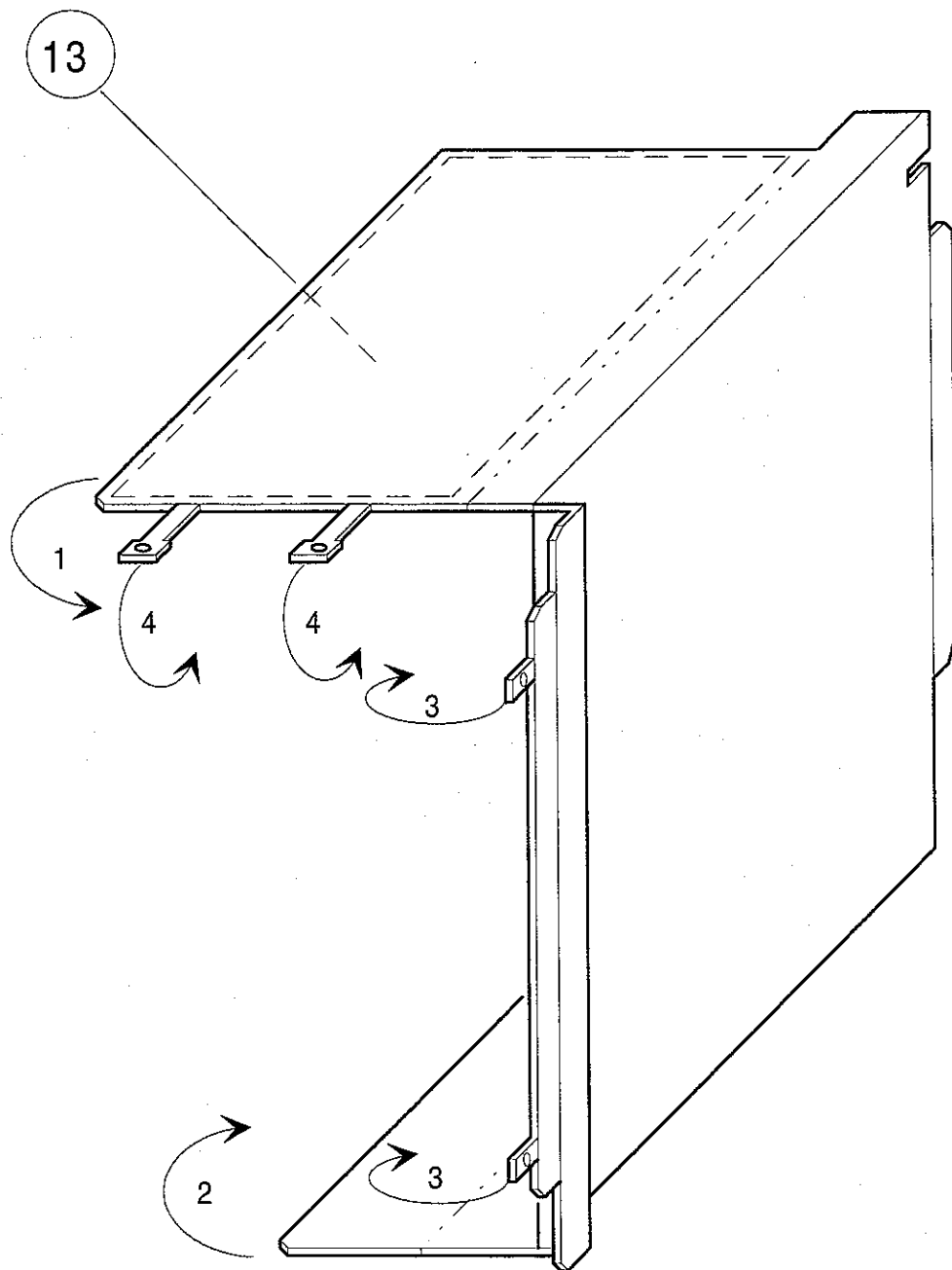


Figure 4 EMC cover

7 EARLIER REVISIONS

All main differences of Memory Module, M-MEM (rev.00) , B-CMMEM (rev.00) and M-MEM (rev.01) , B-CMMEM (rev.01) are noted in this manual.

Nellcor Compatible Saturation Module, M-NSAT (Rev. 01)

All specifications subject to change without notice

Doc. no. 885940-3

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INTRODUCTION

The Datex AS/3 Nellcor Compatible Saturation Module is a single width plug-in module for use with the AS/3 monitors. The module utilizes Nellcor's pulse oximetry algorithm and is designed to be used with Nellcor's pulse oximetry transducers only. Only one pulse oximetry source at a time is allowed by the AS/3 monitors. If M-ESTPR (or M-ESTR) and M-NSAT modules are plugged in the monitor simultaneously, then M-NSAT overrides M-ESTPR (or M-ESTR) as a pulse oximetry source.

I SPECIFICATIONS

I.1 General Specifications

Module size: (W x D x H)	37 x 180 x 112 mm 1.5 x 7.1 x 4.4 in
Module weight:	0.4 kg / 1 lbs
Power consumption	3 W

I.2 Typical Performance

SpO ₂ :	
Measurement range	40 to 100 %
Accuracy (% \pm 1 SD) *)	100 to 80 %: \pm 2 digits 80 to 50 %: \pm 3 digits 50 to 40 %: unspecified
Resolution	1 digit = 1 %
Display averaging	5...7 s
Pulse beep pitch	Varies with SpO ₂ level

The monitor is calibrated over the measurement range against functional saturation SpO₂(func)

HEART RATE FROM PLETH:

Measurement range	20 to 250 bpm
Accuracy	\pm 3 bpm
Resolution	1 bpm
Display averaging	5...7 s
Adjustable pulse beep volume	

PLETH WAVEFORM:

Scales	Automatic scaling
--------	-------------------

*) 1 SD (standard deviation) = 68 % of all readings in the specified range in stable conditions.

Protection against electrical shock Type BF

2 FUNCTIONAL DESCRIPTION

The M-NSAT module contains the following main parts:

- SpO₂ sensor board
- Sensor connector cable
- Nellcor Pulse Oximeter Module MP-203
- NSAT interface board

Sensors can be plugged into the M-NSAT module either directly or using sensor extension cables available from Nellcor. Sensors are plugged into a 9-pin female connector (D-type) on the front panel of the module. This connector is mounted on a small PC board, which is connected by a flat cable to the MP-203.

The MP-203 is a surface mounted PC board manufactured by Nellcor Incorporated. It contains the signal processing electronics and software that are based on Nellcor's stand-alone pulse oximeters. The MP-203 is used with an internal preamplifier.

The measured SpO₂ and pulse rate values, as well as status information, are transferred from the MP-203 to the NSAT interface board. Communication between the MP-203 and NSAT interface board is established through RS232C serial interface. The NSAT interface board, in turn, transmits the measurement information to the module bus of the AS/3 monitor through RS485 serial interface.

The operation of NSAT interface board is illustrated in the block diagram next page.

2.1 NSAT Interface board

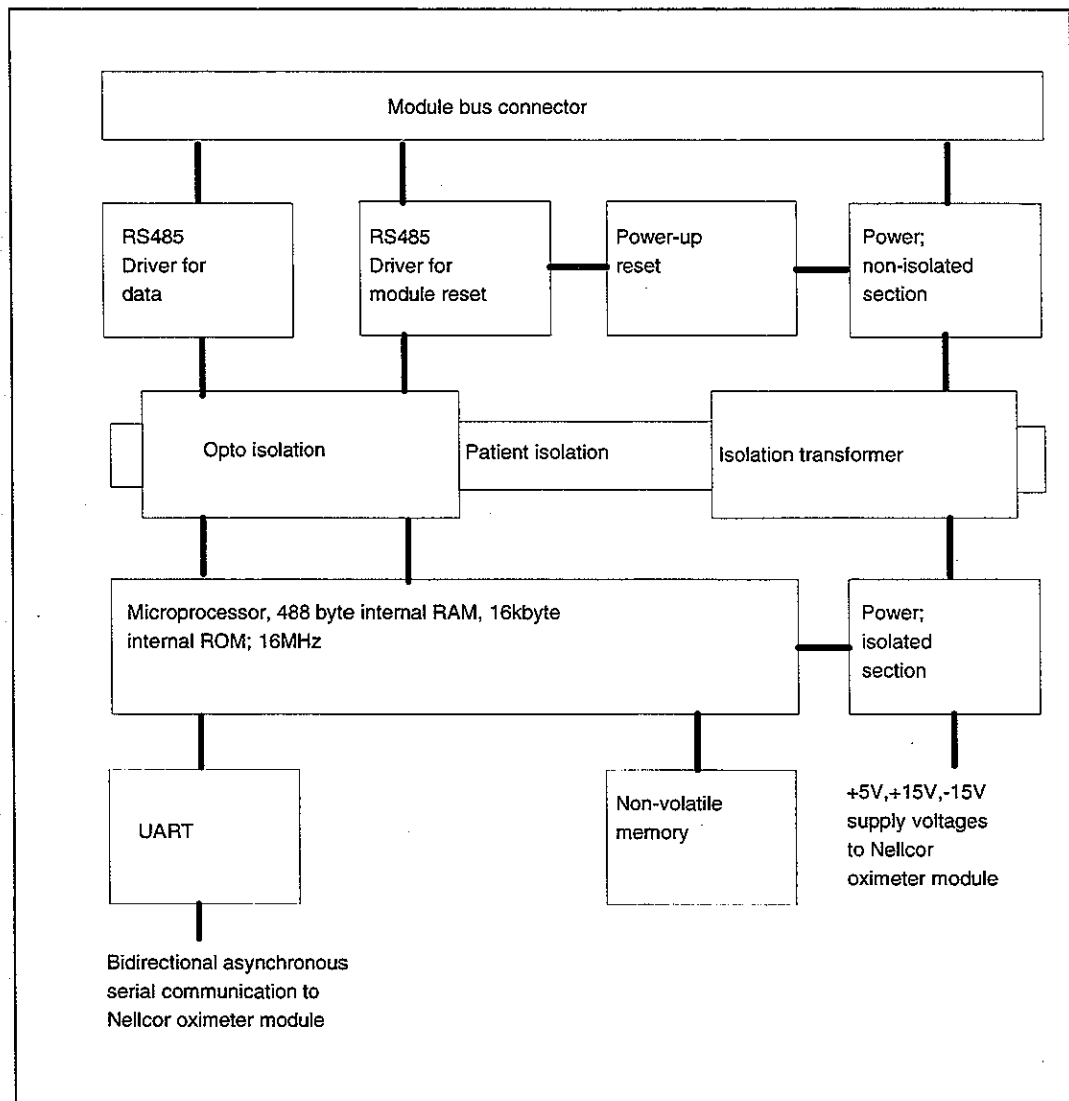


Figure 1 NSAT Interface Board Block Diagram

2.1.1 RS485 drivers

There are drivers for data and for module reset functions.

These drivers are used for driving the RS485 type serial communication bus between the module and the AS/3 Central Unit. Data transmission speed of the bus is 500kbit/s.

In addition to RS485 bus RESET, there is a Power-up reset, which keeps the RESET pin of the CPU active during power up for about 500ms despite of the state at the RS485 bus RESET. This is used to prevent the sending of RS485 data during the RESET of the module.

2.1.2 Power supply, non-isolated section

Power supply is a half bridge type switched mode circuit, where the driver FETs are controlled by a quartz oscillator. The load of the half bridge is the primary of the isolation transformer. The voltage, +15 Vdirty from the AS/3 Central Unit is used as the supply voltage of the switched mode circuit.

2.1.3 Power supply, isolated section

The secondary voltages of the isolation transformer are rectified, filtered and regulated. The voltages can be measured from the test connector X11. See Chapter 2.2.

2.1.4 Opto isolation

The signals of the serial communication bus between the NSAT module and the AS/3 Central Unit are transferred through the patient isolation by the high speed optocouplers.

2.1.5 Microprocessor, UART, Non-volatile memory

The microprocessor with on-chip memory have been used to convert and transfer data from Nellcor pulse oximeter module MP-203 to AS/3 Anaesthesia Monitor.

The communication between MP-203 and the CPU of M-NSAT is realized with the bidirectional asynchronous serial communication via the UART.

The non-volatile memory has been used to store identification information like serial number, control number, date etc.

2.2 Connectors and Signals

Module bus connector

Rear panel 25-pin female D-connector (X1):

Pin No	I/O	Signal
1	I	RESET RS485*
2	I	-15 VDC
3	I	+15 VDIRTY*
4	I	+15 VDC
5	I/O	-DATA RS485*
6	I/O	DATA RS485*
7	-	Ground & Shield*
8	I	-RESET RS485*
9	I	CTSB
10	O	RTSB
11	I	RXDB
12	O	TXDB
13	-	Ground & Shield*
14	I	+32 VDIRTY
15	I	GroundDIRTY*
16	I	CTSC
17	O	RTSC
18	I	RXDC
19	O	TXDC
20	-	ON/STANDBY
21	-	BIT0IN
22	-	RXDD RS232
23	-	TXDD RS232
24	I	+5 VDC*
25	I	+5 VDC

*Used in M-NSAT module

Test connector (X11):

Pin No	Voltage	Name	Note
1	+5V	+5VTEST	Supply voltage to NSAT-board
2	+5V	+5Vn	Supply voltage to MP-203 board
3	+15V	+15Vn	Supply voltage to the MP-203 board
4		GND	FGND
5		-15V	-15Vn
6			N/C

3 SERVICE PROCEDURES

3.1 General Service Information

Usually field service is limited to replacing the faulty circuit boards or mechanical parts. The boards are then returned to Datex for repair.

Datex is always available for service advice. Please provide the unit serial number, full type designation, and a detailed fault description.

CAUTION: Only trained personnel with appropriate equipment shall perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.

3.2 Visual inspection

If the module is disassembled, check that grounding wires and all connectors are properly connected and there are no loose objects inside the module before attaching the module box.

3.3 Functional checks

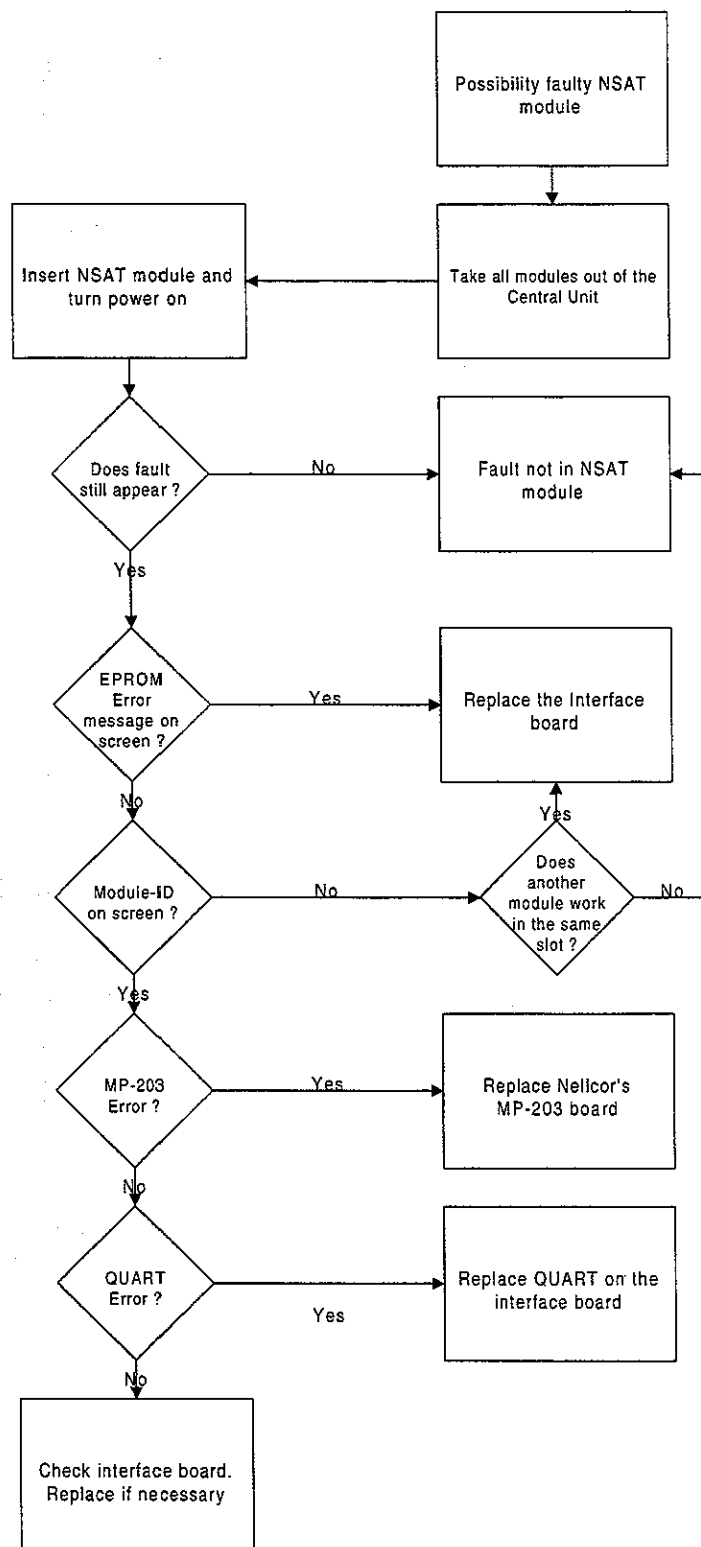
- _: Insert the NSAT module into the monitor frame
- _: Turn the power on by STBY switch. Within 25 seconds, SpO₂ field should appear on the display or replace the SpO₂ field of the plugged ESTPR (or ESTR) module. (If not, select Module to be the SpO₂ source in Interfacing menu (Monitor Setup - Install/ Service) and plug NSAT in again. Check also that pleth is selected on the display.
- _: No error message appears.
- _: Pull out the module. The SpO₂ field disappears or is replaced by the SpO₂ field of the ESTPR (or ESTR) module within 25 seconds. A message 'M-NSAT module removed' appears.
- _: Reinsert the module while the power is still on. The SpO₂ field appears on the display again.

- _: Connect a finger probe to the module. The message Pulse search followed by Check probe in 20 seconds should appear on the display. No waveform coming from NSAT appears.
- _: Attach the probe to your finger. A reading of 95 to 99 and SpO₂ wave form should appear.

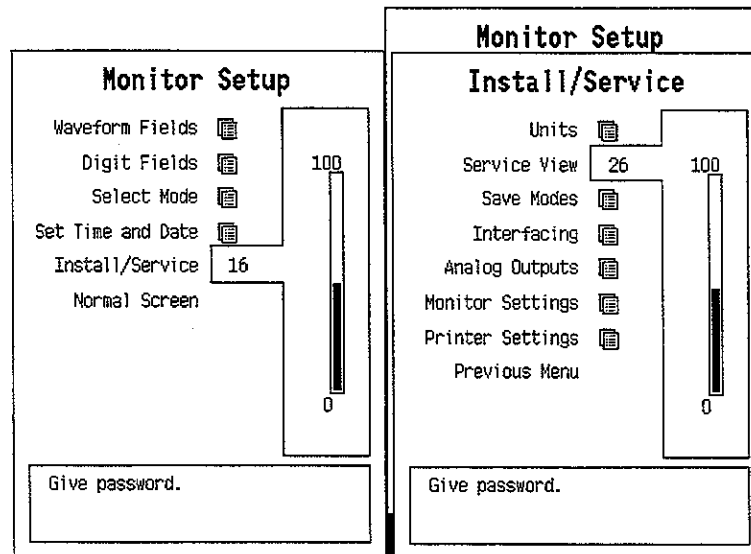
4. TROUBLESHOOTING

PROBLEM	CAUSE	TREATMENT
Message 'No probe'	<ol style="list-style-type: none"> 1. No probe connected to the module 2. Probe faulty 3. Wrong type of probe (not specified to be used with this module) 	<ol style="list-style-type: none"> 1. Check probe connections 2. Change probe 3. Change probe (see possible probe types: Operator's Manual)
Message 'Check probe'	<ol style="list-style-type: none"> 1. No probe attached to the patient 2. The extension cable not connected to the probe 3. Unsuitable site 4. Probe faulty 5. Wrong type of probe (not specified to be used with this module) 	<ol style="list-style-type: none"> 1. See that the probe is properly attached to the patient 2. Check that the probe is connected to the cable 3. Try another place 4. Change probe 5. Change probe (see possible probe types: Operator's Manual)
Finger probe falls off	<ol style="list-style-type: none"> 1. Probe is slippery 2. Finger is too thin or thick 	<ol style="list-style-type: none"> 1. Follow Nellcor's instructions on this matter 2. Try other fingers or other probe types
Weak signal artifacts	<ol style="list-style-type: none"> 1. Poor perfusion 2. Movement artifacts 3. Shivering 	Try another place
Message 'No pulse'	Acceptable pulses were present but have now ceased for 10 seconds	Try other fingers

4.1 Troubleshooting chart



5 SERVICE VIEW



To enter Service Menu during normal operation:

1. Press the MONITOR SETUP key.
The Setup menu appears.
2. Turn ComWheel to highlight Install/Service and push.
3. Give the password by turning the ComWheel to display each password number and confirm the number by pushing the ComWheel. Password numbers are 16 - 4 - 34.
The Install/Service menu appears.
4. Turn the ComWheel to highlight Service View and push.
5. Give the password by turning the ComWheel to display each password number and confirm the number by pushing the ComWheel. Password numbers are 26 - 23 - 8.
6. Turn the ComWheel to highlight the M-NSAT module and push.
7. Turn the ComWheel to highlight the right module and push.

5.1 M-NSAT Service menu

M-NSAT		NSAT Data	
Previous Menu			
		PR	---
		SpO2%	---
		NoProbe	0
		PulseSearch	0
		NoPulse	0
		CheckProbe	1
		MP-203 Error	No
		QUART Error	No
		I/O Error	No
		Timeouts	0
		Bad checksums	0 ROM OK
		Bad c-s by mod	0

PR shows the pulse rate value [bpm] calculated from pleth.

SpO₂% shows the oxygen saturation value multiplied by 100.

Next are listed the **messages** that are sent from the module to the monitor. Digit '0' means that the message is not active, '1' is for the active one.

MP-203 Error is set as Yes if any error message is sent by the Nellcor MP-203 board.

QUART Error displays Yes if an error is detected in the data communications device QUART which is located in the Interface board.

The status of **I/O Error** is Yes when an error occurs in the communication between MP-203 and the Interface board.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to monitor broke down.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.

The AS/3 Monitor starts counting these items at power up and resets to zero at power off. The nonzero values do not indicate a

failure, but the continuous counting (more than 50 per second) indicates either serial communication failure, or module not in place. Also other modules can cause communication errors that cause these numbers rise.

ROM indicates whether the checksum in the EPROM is in accordance with the one the software has calculated.

The state is either **OK**, **Fail** or ? (module not in place or a communication error).

6 SPARE PARTS

6.1 Spare part lists

NOTE: Only changed part numbers are listed under later revisions. To find the desired part: check first the list of the revision that corresponds your device. If the part is not listed there, check the previous revision, etc. until you find the right number.

NOTE: Accessories are listed in the booklet AS/3 Supplies and Accessories.

Item numbers refer to the exploded view in chapter 6.2.

Nellcor Compatible Saturation Module, M-NSAT

Rev. 00

<u>Item</u>	<u>Item description</u>	<u>Order No.</u>
6	Interface board, M-NSAT	*884383
7	SpO2 measuring board, M-NSAT	*90310
8	Jumper	54091
9	Connector board, M-NSAT	*884950
4	Front panel frame, M-NSAT (Rev. 00)	884012
10	Front panel sticker, M-NSAT (Rev. 00) (Eng)	884424
10	Front panel sticker, M-NSAT (Rev. 00) (Ger)	885779
10	Front panel sticker, M-NSAT (Rev. 00) (Fre)	885780
10	Front panel sticker, M-NSAT (Rev. 00) (Spa)	886192
10	Front panel sticker, M-NSAT (Rev. 00) (Swe)	886126
10	Front panel sticker, M-NSAT (Rev. 00) (Dut)	886125
10	Front panel sticker, M-NSAT (Rev. 00) (Ita)	886759
14	EMC-cover, M-NSAT	884701
12	Insulation plate 1., M-NSAT	884700
13	Insulation plate 2., M-NSAT	884705
1	Module box (single width)	886167
3	Latch	879181
2	Spring pin	879182
11	Metal frame	879184
5	Cross recess screw M3x8 black	616215
13	Cross cylinder head screw M3x6	61721
14	Cross cylinder head screw M3x12	628700
15	Cross cylinder-head screw M3x8	628712
16	Bushing	(640430) Use 63392

Rev. 01

<u>Item</u>	<u>Item description</u>	<u>Order No.</u>
4	Front panel frame, M-NSAT (Rev. 01)	887842
10	Front panel sticker, M-NSAT (Rev. 01) (Eng)	888296
10	Front panel sticker, M-NSAT (Rev. 01) (Ger)	888297
10	Front panel sticker, M-NSAT (Rev. 01) (Fre)	888298
10	Front panel sticker, M-NSAT (Rev. 01) (Spa)	888299
10	Front panel sticker, M-NSAT (Rev. 01) (Swe)	888335
10	Front panel sticker, M-NSAT (Rev. 01) (Dut)	888336
10	Front panel sticker, M-NSAT (Rev. 01) (Ita)	888337
10	Front panel sticker, M-NSAT (Rev. 00) (Fin)	888874
16	Bushing	63392
17	Cable lock, M-NSAT	887706

* = the part is recommended for stock

6.2 Exploded View

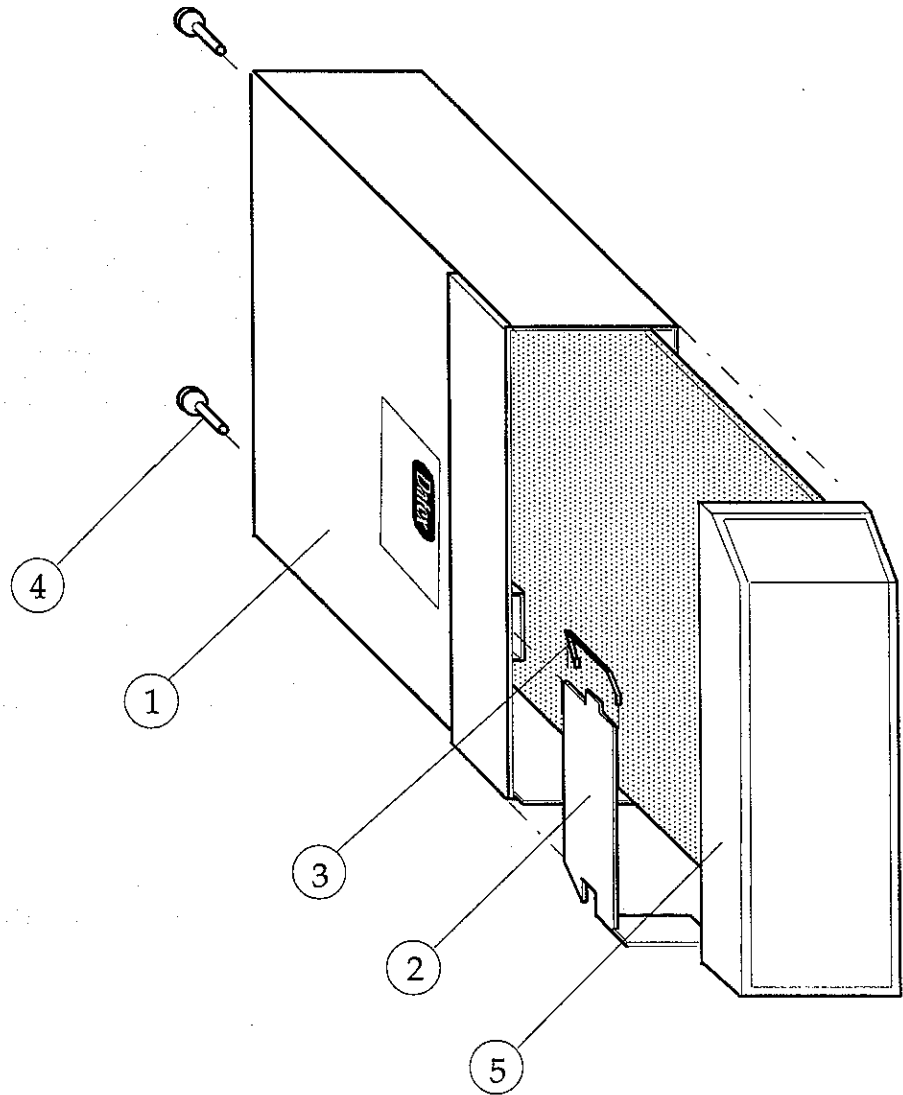


Figure 2 Exploded View of Module Box

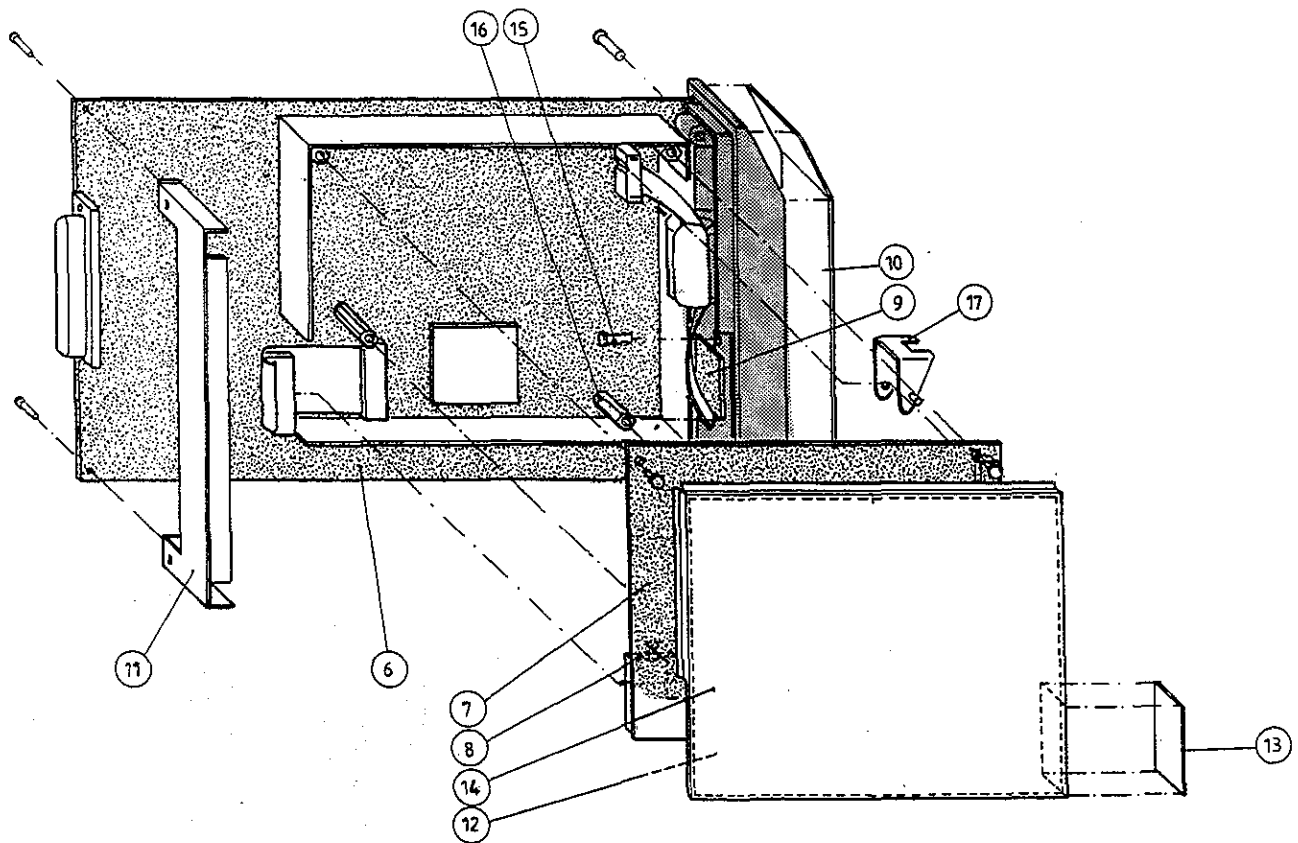


Figure 3 **Exploded View of the M-NSAT Module**

7 EARLIER REVISIONS

This manual fully supports earlier revision of M-NSAT module.

